

# CHAPTER 600 STREET LIGHTING

The standards and specifications found in this chapter are for the materials and construction of street lighting within the Village of Lombard.

Major developments require street lighting to be provided. Refer to the Subdivision and Development Ordinance Section 154.306 for requirements.

## SECTION 600.01 DESIGN AND CONSTRUCTION

All work performed and all materials used in connection with the installation of any public roadway lighting or appurtenances shall be in accordance with the requirements of the appropriate standards of the National Electric Manufacturers Association; Underwriters Laboratory approvals, American Association of the State Highway and Transportation Officials criteria, the latest edition of the Illinois Department of Transportation "Standard Specifications for Road and Bridge Construction" and Highway Standards. All as modified by the following.

## SECTION 600.02 DESIGN

All lighting shall be designed in accordance with the latest requirements of "American National Standards Practice for Roadway Lighting" and the following criteria:

### ROADWAY ILLUMINATION

<b>Roadway Classification *</b>	<b><u>RESIDENTIAL</u></b>		<b><u>INDUSTRIAL/COMMERCIAL</u></b>	
	<b>Minimum Maintained Foot-candles Residential</b>	<b>Uniformity Average to Minimum</b>	<b>Minimum Maintained foot-candles Ind/Comm.</b>	<b>Uniformity Average to Minimum</b>
Arterial	0.6	4:1	1.2	3:1
Collector	0.4	4:1	0.9	3:1
Local	0.2	6:1	0.6	3:1

- Please refer to the comprehensive plan, Figure 5, Transportation Plan for Roadway Classifications.

## **SECTION 600.03**

### **APPROVAL OF MATERIALS**

Electrical materials shall be new and of the type and kinds listed by the Underwriters Laboratory and meeting AASHTO criteria. Before any work is started, the contractor shall obtain written approval from the Village of Lombard Public Works Department to install materials he proposes to furnish. Thirty (30) days prior to starting construction, he shall submit the following to the Village for approval.

- A) Poles and Brackets
  - 1. Letter from the manufacturer certifying that the poles to be furnished meet the requirements of all specifications.
  - 2. Three copies of drawings showing each type of pole and bracket arm and including, for both, the types of material, dimensions, thickness of material, method of fabrication and description of details.
  
- B) Luminaires
  - 1. Three copies of photometric data including ISO-foot candle diagram, utilization curve, and ISO candela diagram.
  - 2. Description of ballast.
  
- C) Controller
  - 1. Three copies of manufacturer's descriptive and application data for: circuit breakers, cabinet, pedestal and insulating panel board.

## **SECTION 600.04**

### **POLE**

The lighting pole shall be designed in accordance with the "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", by the American Association of State Highway and Transportation Officials (AASHTO), latest edition. A minimum of 80 mph design wind velocity with a 104 mph gust velocity shall be used.

The type of pole to be installed shall be determined by the Village and is dependent upon the location in the Village. The designer shall contact the Private Engineering Services Division for the appropriate type of pole.

Spun Aluminum poles:

1. Hapco Series 20 Poles W/Tapered Elliptical Arms- catalog # 21-587 – 30' mounting height, 28' pole height, 8' mast arm.
2. Hapco Series 30 poles W/Truss Arms- catalog #31-565-30' mounting height, 27'-2" pole height, 8' mast arm.

Concrete Poles:

Straight Base:

1. Centrecon Series "S" Small Octagonal pole catalog #SEO-4.3 – 14'-0" mounting height, overall pole length 18'-0", color # 113 Natural Exposed when installing either post-top luminaires. When installing Street Lighting Equipment Corp luminaires the pole needs to supply SCC aluminum tennon, for the Holophane luminaires needs a 3" OD tennon.

Flared Base:

1. Centrecon model VEM -4.6 octagonal as manufactured by Ameron.
2. Stress Crete model KS15 octagonal.

Flared base poles shall have a 15' mounting height.

Steel Poles:

1. T.I.F. District: Lumec Light Poles – catalog #RS61A-12-BAD22.625 (2)-DR-IP-BRL- LMS5069B.
2. Square Tube – 35' length, 7.98 X 4' tapered square light pole, W/6' mast arm.

Spun Aluminum Poles shall be equipped with the following:

1. Spun Aluminum poles shall have an aluminum pole cap.
2. A wiring handhole with a heat-treated aluminum alloy door of not less than twenty (20) square inches in area placed ten (10) to twenty (20) inches above the finished grade, or a 5-1/8" x 7-9/16" reinforced handhole with a flush-mounted, countersunk, vandal-proof cover with stainless steel machine attachments or approved equal.

Prior to erecting the poles, the contractor shall obtain written approval from the Village for the procedure he proposes to use to gauge the plumbness of the poles. Shims are not allowed in plumbing the poles. One of the following methods is recommended:

1. The pole shall be considered plumb when a thirty (30) inch or larger spirit level, with offsets at the top equal to the pole taper, indicates when used at eye level that the center line of the pole is within one half (1/2) inch per ten (10) feet of true vertical in any direction.
2. The pole shall be considered plumb when the center of the top is directly over the center of the base as determined by viewing the pole through a tripod-mounted, accurate, quality transit from two (2) angles at least sixty (60) degrees apart. Deviation shall not exceed one half (1/2) inch in ten (10) feet.

The end of the mast arm shall be level or rise not more than five (5) degrees when the pole is erect and the luminary is attached. The mast arm shall rise not more than nine (9) inches for each twelve (12) inches of span, the amount of rise being measured between the slip fitter end and the attachment at the pole of the top member. All mast arms shall be designed in accordance with the "Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals" by AASHTO.

If the manufacturer proposes that any dimensions be less than that specified, he shall submit computations showing the amount of horizontal and vertical deflection of the slip fitter end of the mast arm when the proposed pole is erect and a fifty (50) pound luminary is mounted. Static ice free and wind free conditions shall be assumed in these computations. Horizontal deflection shall not exceed 0.6% of the mounting height.

## **SECTION 600.05**

### **POLE FOUNDATIONS**

The street light foundation shall be Class SI, Portland cement concrete with a minimum twenty-eight (28) day compressive strength of 3500 PSI, using a minimum six (6) bag mix. The foundation shall be constructed as per attached details. The foundation shall be set with the top two (2) inches above grade. The top twenty-four (24) inches shall be formed with substantial forms firmly held to accurate level and grade. These forms shall include a template for the anchor bolts and wire way. The bottom of the foundation below the twenty-four (24) inch deep form shall be placed without forms against the undisturbed earth sides of the hole. The minimum depth of foundation shall be seventy-two (72) inches below grade and meet manufacturers' minimum specifications. The depth of foundation shall be designed for the specific use.

The exposed portion of the foundation shall be finished smooth. The top shall be level within 1/16 inch from side to side and flat within plus or minus 1/16 inch. Shims and grout will not be permitted to plumb the pole.

The foundation shall be allowed to set and cure for seven (7) days before the pole is set, during which time the anchor bolt ends and exposed concrete shall be protected from mechanical and weather damage.

Street light foundations shall be located behind the adjacent curb in accordance with the following table unless otherwise noted:

<b>Roadway Classification</b>	<b>Residential</b>	<b>Indus/Comm.</b>
Arterial	2' minimum	2' minimum
Collector	2' minimum	2' minimum
Local	2' minimum	2' minimum

The two (2) foot offset is minimum. A greater distance may be approved which will affect the mast arm length.

**SECTION 600.06  
LUMINAIRES**

All luminaires shall be Type II unless otherwise approved, conforming to the patterns specified in 2.3.2.1 of the American Standard Practice for Roadway Lighting. Such luminaires shall have medium distribution as specified in 2.2.2 and semi-cutoff as specified in 2.4.2. of the American Standard Practice for Roadway Lighting.

The specific luminaires to be used in a particular location will be determined by the Village. The Designer shall contact the Private Engineering Services Division for the type of luminaires to be used.

Post-Top

L.E.D.

1. Sternberg model MS805BLED to SF 7” O.D. Tenon/ARC 30T3/PA/BK.
2. Lumec model (L70-001)-90W49 LED3K-GL-FC-LE3-120-SF7TN-BKTN.

Mast Arm Mounted

American Electric Lighting – Autobahn Series ATB2

## **SECTION 600.07 GROUNDING**

Light poles shall be grounded as follow:

1. Direct burial pole: one 10' X 5/8" ground rod per pole.
2. Bolt down base and control center: one 12' X 5/8" ground cast into the foundation or base.

## **SECTION 600.08 ELECTRIC CABLE, CONDUCTORS AND CABLE DUCT**

All cable, conductor and ducts shall be new, having been manufactured within twelve (12) months of the date of installation. The duct shall be delivered in complete coils or reels with identifying Underwriter's tags and labels attached including size, type of insulation, voltage, and manufacturer's name and shall be in first class condition when installed.

Materials shall be packaged by the manufacturer and delivered with identifying Underwriter's tags and labels attached. All Underwriter's labels and tags shall be permanently removed from the reels and cartons by the Village representative for his records. None shall be returned.

Cables and conductors will be subject to inspection for acceptance as to quality, conditions, and installation during final inspection. Unit duct shall be subject to inspection for acceptance as to installation during construction. All poles within this system must contain Buss Heb AA fuse kit with Buss 1Ao512 rubber boots or approved equal.

All underground conductors and ground wire shall be # 6 AWG THW CU copper, soft and annealed and shall conform to ASTM Specification for stranded conductors. Additional modern wiring type insulations could be THWN, or THHN/THWN (dual rated) or other "W" rated wire types. All pole wiring shall be a "W" rated wire due to the outdoor environment or THHN unless dual rated. Copper conductor insulation shall be heat and moisture resistant plastic suitable for use at 90 degrees C in wet locations at 600 volts. The wiring system shall be a parallel system with minimum of three insulated conductors: black, red, and neutral-colored white, or approved equal.

All cable duct shall be NRTL listed, one and one-quarter (1 ¼) inches in diameter, with a minimum tensile strength of 2000 psi, a minimum elongation of 300 percent, a minimum dissipation factor of 0.005, and a maximum dielectric constant of 2.90 as per standard ASTM test methods for such materials. The duct must withstand the impact and bending

stresses incidental to transportation, handling and installation at temperatures as low as minus 50 degrees F. It shall not fracture, split, or collapse by normal handling at this temperature. Cable duct shall extend into a pole until the duct and cable extend from the handhole. Slack shall be neatly folded into the cavity in such a manner as to separate the various splices and keep them as high above grade as possible. Slack shall be sufficient to withdraw the splice from the handhole not less than twenty-four (24) inches. The cables shall extend without splice into a control cabinet and terminate without splice on the terminals of the control.

## **SECTION 600.09 CONDUCTOR SPLICES**

Splices in handholes below grade level shall be Scotch cast kits or equivalent. Splices other than in handholes are not allowed.

## **SECTION 600.10 CONDUIT**

For the following, conduit shall be pushed or trenched rigid galvanized steel (RGS) or intermediate metal conduit or HDPE Schedule 80, a minimum of two (2) inches in diameter and complying with Underwriter's Laboratories, Inc. Standard U.L. 6 and ASA specification C80-1 or approved equal, bearing an Underwriter's Laboratories label:

1. Street light foundation raceways.
2. Control cabinet foundation raceway.
3. All pavement crossings (to be extended two (2) feet beyond the back of curb and industrial/commercial driveways).
4. Street light control cabinet to Commonwealth Edison connection shall be two (2) inch rigid galvanized steel conduit.

Underground utilities of all types shall be a minimum of five feet horizontally and eighteen inches vertically from any water main, sanitary sewer and storm sewer. Electrical utilities of at least 50 Volts under a public roadway, public driveway apron or public sidewalk shall be in RGS conduit or HDPE Schedule 80 pipe approved for electrical use by a nationally recognized laboratory and buried at least 24 inches below grade per NEC Table 300.5.

Table 300.5 Minimum Cover Requirements, 0 to 600 Volts, Nominal, Burial in Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit									
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit or Intermediate Metal Conduit		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or in Other Identified Cable or Raceway	
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
All locations not specified below	600	24	150	6	450	18	300	15	150	6
In trench below 50-mm (2-in.) thick concrete or equivalent	450	18	150	6	300	12	150	6	150	6
Under a building	0	0	0	0	0	0	0	0	0	0
	(in raceway only)						(in raceway only)		(in raceway only)	
Under minimum of 102-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.) beyond the underground installation	450	18	100	4	100	4	150	6	150	6
							(direct burial)			
							100	4		
							(direct burial)			
Under streets, highways, roads, alleys, driveways, and parking lots	600	24	600	24	600	24	600	24	600	24
One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes	450	18	450	18	450	18	300	12	450	18
In or under airport runways, including adjacent areas where trespassing prohibited	450	18	450	18	450	18	450	18	450	18

## SECTION 600.11 CONTROL CABINET

All lighting systems shall include a weatherproof cabinet housing the street light controls. All construction shall be in accordance with the attached details. All systems shall be 120/240 volt.

The cabinet shall be listed by a NRTL, made of aluminum or steel coated with an approved epoxy paint; have a hinged gasketed door with a flush mounted, keyed lock and the words "Street Lights" or "Lighting Controls" cast on the front; have a screened vent weatherproof opening; and shall have an adapter for mounting on a four and one-half (4 1/2) inch O.D. tubular steel post, or approved equal. A concrete foundation in accordance with the attached detail shall support a cast iron base for the post.

The cabinet shall contain the following equipment:

1. 100 amp service breaker.
2. 30 amp branch circuit breakers - single or double pole.
3. 15 amp control breaker.
4. 4 circuit buss bar.
5. Approved contactor with operating coil.



6. Ground terminal block.
7. Single pole Type S3 secondary lightning arrestors.
8. 12 circuit buss bar (if applicable).
9. 15 Amp receptacle.
10. Single pole bypass switch.

The control cabinet shall be a Crouse-Hinds #46394, size 28 or approved equal.

The control cabinet and electrical service shall be inspected by the Building Division Electrical Inspector.

The contractor shall arrange with the local electric power company for electric service and shall bear the expense of any charges by the power company to furnish the service connection.

## **SECTION 600.12 HANDHOLE**

Concrete handholes shall be constructed at all street intersections and wherever there is change in alignment of the cable greater than twenty (20) degrees. No handhole will be required where the cable is installed with a radius of twenty (20) feet or greater.

Street lighting handholes shall be Class SI Portland cement concrete with a minimum 28 day compressive strength of 3500 psi using a six (6) bag mix. All duct shall extend into the handhole a minimum of four (4) inches with a minimum of six (6) feet of cable pulled into the handhole for splices per conductor run. All handholes shall contain hangers of an approved type for cable slack. All handholes shall contain a frame and lid with the designation "Street Lighting" cast therein.

## **SECTION 600.13 TRENCH AND BACKFILL**

All installation of the cable duct and cable between poles shall be placed in trenches six (6) inches wide and twenty-four (24) inches deep. Plastic warning tape shall be placed twelve (12) inches above the cable duct.

Inspections at each of the following stages of trench construction, and at any other stage the Village designates, are required by a Village representative.

1. Inspection of sample length of trench.

2. Inspection of installed unit-duct, and conductors for sharp bends.

Where conduit enters the trench, compacted approved fill shall be placed to half-fill the opening in the conduit so that the emerging cable-duct will have a smooth bed at this critical point. If the trench depth is less than twelve (12) inches because of obstructions, the contractor shall cut a groove in such obstruction so the trench is twelve (12) inches deep. The cable-duct shall be laid in this groove and anchored to prevent floating. Where trench depth exceeds twelve (12) inches but is less than twenty-four (24) inches, the bottom shall be made smooth and free of short radius dips by filling low sections with trench backfill. The cable duct shall be installed and anchored to prevent floating. The remaining backfill shall be as specified below. Any materials excavated from the trench, which in the opinion of the Village is satisfactory backfilling material, may be used. Cinders, frozen earth, or other deleterious materials will not be permitted in the backfill. Stones shall be less than two (2) inches in any dimension.

Backfilling shall be completed as soon as possible after inspection. Backfill shall be deposited in uniform layers not exceeding six (6) inches thick loose measure. The materials in each layer shall be mechanically compacted in a manner approved by the Village.

Plowing which places all cable duct of a circuit in a single cavity so that they are not twisted, kinked, or damaged and are the specified distance below grade is an acceptable method of installation. Conduit and unit duct may also be installed by directional drilling.

## **SECTION 600.14**

### **WIRING TEST**

The tests outlined in this section are field tests required to be performed in the presence of the Village representative. They shall be performed by the contractor's personnel and equipment. Defects shall be corrected and testing repeated until all sections of the installation are sound. Splicing or repairing of insulation below grade is not permissible except in a handhole.

All construction shall be finished when tests are made. The poles shall be erected, with ballasts and lamps in place. Trenches shall be backfilled and all connections shall be made up.

Insulation resistance shall be measured with a megger generating not less than 500 or more than 1000 volts. A multimeter is not acceptable because it applies only a few volts which will permit some insulation defects to go undetected. Erratic behavior of the megger during the test indicates an intermittent weakness which must be corrected. Only lower values indicated shall be considered or recorded.

The Village representative shall log the serial number and voltage rating of the megger used by the contractor. He shall then confirm the calibration of the megger by connecting the two (2) leads of the megger together so that the resistance to be measured by the megger when it is turned at full speed is zero. Unless this is true, the megger will give false readings under all other circumstances as well.

Each circuit shall be permanently tagged for identification and then tested at the control centers. The full voltage of the megger shall be applied between ground and each insulated wire in each circuit. The ground shall consist of a driven, copper-clad rod 8' x 5/8" or larger connected by #8 wire to the power company ground in the control cabinet. Circuits shall be isolated from each other by opening the circuit breakers.

The minimum acceptable resistance to ground shown by the megger shall be as follows:

<u>Wire Tested</u>	<u>Minimum Megger Resistance to Ground</u>
To power source	40 megohms minimum
To photocell	40 megohms minimum
1 to 2 lights connected to wire being tested	40 megohms minimum
3 or 4 lights connected to wire being tested	20 megohms minimum
5 to 8 lights connected to wire being tested	10 megohms minimum
9 or more connected to wire being tested	5 megohms minimum

The megger shall be operating at full crank speed when it is read. If the needle fluctuates, the lowest resistance value shall be recorded.

If any conductor has less resistance than that shown above, it shall be rejected regardless of atmosphere, ground water, or other condition which may be alleged to be the reason. Defective cables shall be replaced and retested until satisfactory.

Voltage Regulation and Current Balance Tests: it is the purpose of these tests to confirm the design values of voltage drop and the accuracy of the installed wiring layout. The test shall be performed in the sequence given as rapidly as possible except for the five (5) minute warm up. Only one (1) voltmeter and one (1) ammeter shall be used to eliminate

discrepancies between instruments. The instruments shall not be adjusted after testing begins.

1. Turn lights on and record "starting" current in supply phase wires A and B.
2. After lights are on the five minutes:
  - a. Record "operating" current in phase wires A and B.
  - b. Record phase voltage.
  - c. Record voltage of same circuit at control center to determine voltage drop between end lamp and control center.
  - d. Record voltage of same circuit at control center to determine voltage drop between end lamp and control center.
  - e. Record current in each lighting circuit.

Note that the form suggested for these records is on the following page, and where it is necessary, change phase wire identification to indicate phase C on the record of tests.

## **600.15 TEST BURN**

As part of the testing and acceptance, the street lights shall be turned on for a period of not less than seven (7) days, cycling normally per the light sensor. Any components that fail during the test burn shall be replaced prior to acceptance by the Village.